

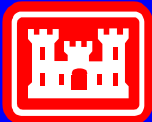
DoD Stationary Fuel Cell Demonstration Program

Dr. Michael J. Binder

217-373-7214, m-binder@cecer.army.mil

Distributed Generation (DG) and Combined Heat and Power (CHP)
for Federal Facilities

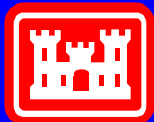
Radisson Hotel Newport Beach
Newport Beach, California
May 13-15, 2003



US Army Corps
of Engineers

Engineer Research & Development Center

Some Fuel Cell Companies



DoD PAFC Demonstration Program

- **DUECC Request for CERL Assistance**
- **FY93 Congressional Appropriation - \$18M**
- **FY94 Congressional Appropriation - \$18.75M**
- **Specify “...natural gas fuel cells in production in the United States...”**

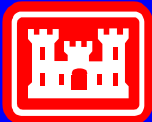
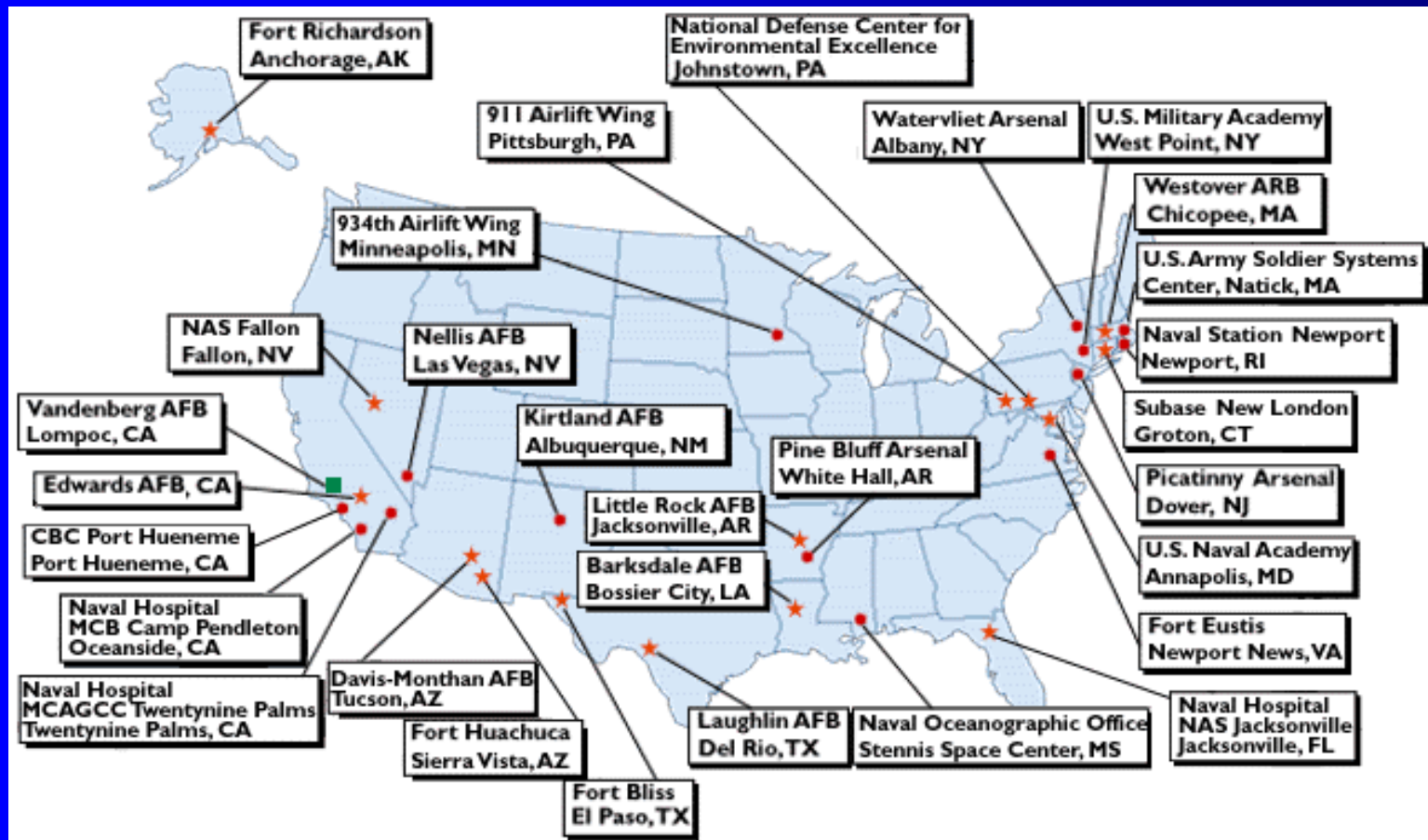


Turn-key Package

- **IFC PC25 Fuel Cell Power Plant**
 Fy93 - 1 ea. Model A, 11 ea. Model B
 Fy94 - 3 ea. Model B, 15 ea. Model C
- **Engineering Design / Installation**
- **Training for Site Personnel**
- **60 Months Maintenance**
- **Diagnostic / Remote Monitoring Computer**



DoD PAFC Program Sites



Fleet Performance Summary

(29 Power Plants)
As of 31 January 2003

- Total Run Time 819,428 hrs
- Availability
 - Model B Fleet 57%
 - Model C Fleet 75%
- Energy \$ Saved \$5,724,196
- NOx Abated 266.0 tons
- SOx Abated 566.2 tons
- CO Abated 23.0 tons
- CO₂ Abated 34,074.6 tons



Climate Change “Rebate” Program Objectives

- Reduction of Fuel Cell Prices via Economy of Scale
- Proactive Approach for DoD Involvement



“Rebate” Program Highlights

- Grant Money Available / Fiscal Year**

FY03	~\$6.0M
FY02	\$ 2.8M *
FY01	\$ 0.0M
FY00	\$ 2.0M
FY99	\$ 2.3M
FY98	\$ 4.2M
FY96/97	\$10.6M
FY95	\$ 8.2M

- Cost-Shared Program Incentives**

\$1,000 / kW up to 1/3 of the total cost

***Solicitation No. DE-PS26-03Nt41463 available at**

<http://e-center.doe.gov>



Application Rating Criteria

- Firmness of Financial Commitment (15%)
- Site Information (15%)
- DoD Relationship (40%)
- Project Merit (30%)



DoD Fuel Cell Test & Evaluation Center (FCTec)



FCTec Site - Johnstown, PA



US Army Corps
of Engineers

Engineer Research & Development Center

FCTec Description

- The FCTec is located in Johnstown, PA at Concurrent Technologies Corporation's (CTC's) Environmental Technology Facility.
- The FCTec is a National Resource for the independent, unbiased testing and validation of fuel cell power plants for military and commercial applications.
- FCTec's primary goal is to significantly accelerate the development and commercialization of fuel cell power plants.



FCTec Services

- Independent Demonstration and Validation of Fuel Cell Power Plants Up to 550 kW
- Testing Fuel Cells Continuously, 24 Hours a Day, 7 Days a Week
- Providing Computerized Process Control and Data Acquisition Capability Including Protected, Internet Data Access
- See Website for Specific Testing Capabilities
www.fctec.com



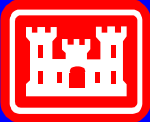
FCTec - Benefits

- Accelerated Development of Fuel Cell Power Plants
- Access to Both Government & Industry Clients
- Designed for Simple Operation, Maximum Flexibility



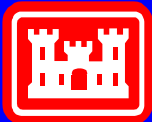
FCTec Additional Info

- www.fctec.com
- **Mike Binder**
Ph. (217) 373-7214
m-binder@cecer.army.mil
- **Bob Unger**
Ph. (814) 269-2721
ungerb@ctcgsc.org



Residential Fuel Cell Demonstration Program

- PEM Units, 1 kW to 20 kW
- US Military Facilities/Embassies, etc.
- Turn-key Packages Requested
- Maximum Diversity Desired
- 1 Year of “Fuel Cell Power” Required
 - (90% Availability)



“PEM” Program Highlights

- Grant Money Available / Fiscal Year**

FY03	~\$3.5M *	
FY02	\$ 3.0M	(24 Units)
FY01	\$ 3.0M	(21 Units)

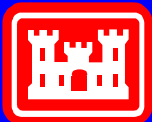
- No Cost-Share Required**



FY01 Residential PEMFC Demonstration Program

SITE APPLICATION MATRIX

Site Name	Building Application	Fuel Cell Manufacturer	Input Fuel	Size (kW)	No. Units	Cogen. Y/N
Sierra Army Depot	Barracks	H Power	Propane	4.5	1	Yes
Brooks AFB	Base Housing	Plug Power	Natural Gas	5	3	No
MCB Kaneohe Bay	TBD	TBD	TBD	TBD	1	TBD
Ft. Bragg	Office Building	Plug Power	Natural Gas	5	1	No
Ft. Jackson	Officer's Quarters	Plug Power	Natural Gas	5	1	Yes
Barksdale AFB	Office Building	Plug Power	Natural Gas	5	1	No
Patuxent River NAS	Office Building	H Power	Propane	4.5	1	Yes
Patuxent River NAS	Office Building	H Power	Natural Gas	4.5	1	Yes
Geiger Field	Office Building	Avista Labs	Hydrogen	3	1	No
Watervliet Arsenal	Research Facility	Plug Power	Natural Gas	5	3	No
Watervliet Arsenal	Manufacturing Facility	Plug Power	Natural Gas	5	3	No
Watervliet Arsenal	Officer's Quarters	Plug Power	Natural Gas	5	4	No

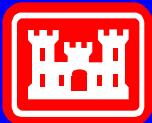


(x) Indicates output setpoint of unit

FY02 Residential PEMFC Demonstration Program

SITE APPLICATION MATRIX

Site Name	Building Application	Fuel Cell Manufacturer	Input Fuel	Size (kW)	No. Units	Cogen. Y/N
Saratoga Springs NSU	Base Housing	Plug Power	Natural Gas	5	8	Yes
West Point Military Academy	Officer's Quarters	Plug Power	Natural Gas	5	3	Yes
USCG Aids to Navigation Team	Maintenance Facility	Nuvera	Natural Gas	5	2	No
Fort Belvoir	Office Building	H Power	Hydrogen	0.5	3	No
Naval Surface Warfare Center	Portable Test Facility Buildings	H Power	Propane	4.5	2	No
Robins AFB	Fire Station	Plug Power	Natural Gas	5	1	Yes
North Carolina Agricultural & Tech (NCA&T)	Reserve Officer Training Corps (ROTC) Facility	Plug Power	Natural Gas	5	1	Yes
Shaw AFB	Base Housing	Plug Power	Natural Gas	5	1	Yes
McChord AFB	FAA Radio Transmitter	Avista Labs	Hydrogen	0.5	6	No



FY01 PEM Program Sites



**Barksdale AFB
Base Housing**



**Brooks AFB
Base Housing**



**Fort Bragg
Office Building**



**Sierra Army Depot
Barracks and Swimming Pool**



FY01 PEM Program Sites



**Patuxent River NAS
Office Building**



**Patuxent River NAS
Officer's Quarters**



**Fort Jackson
Officer's Quarters**



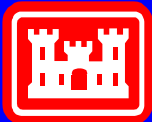
PEMFC Installed at Geiger Field Spokane, WA



Building 401



Avista Labs 3kW Fuel Cell



US Army Corps
of Engineers

Engineer Research & Development Center

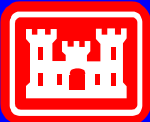
Geiger Field Performance Summary

March 29, 2002 – January 31, 2003

- Total Run Time 6,222hrs
- Availability 93.3%
- Capacity Factor 24%
- Total Electric Output 5,318 kWh
- Avg. Output for Site 0.71 kW
- Electrical Efficiency 25%



PEMFCs Installed at Watervliet Arsenal



Watervliet Arsenal

Performance Summary

Site 1 – Officers' Quarters (4 units)

January 15, 2002 – January 21, 2003

- Total Run Time 32,493 hrs
- Availability 91.4%
- Capacity Factor 50.1%
- Total Electric Output 81,361 kWh
- Avg. Output for Site 10.0kW
- Electrical Efficiency 23.9%



Watervliet Arsenal

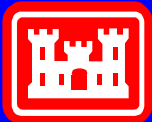
Performance Summary

Site 1 – Officers' Quarters (4 units)

January 15, 2002 – January 21, 2003

Site Performance Matrix

System No.	Total Run Hours	Total Hours	Availability (%)	Capacity Factor (%)	Total Energy Produced (kWe-hrs AC)	Average Output (kW)	Electrical Efficiency (%)
B95	8032	8894	90.3%	48.7%	19578	2.44	23.4%
B96	7946	8911	89.2%	49.7%	19761	2.49	23.4%
B97	8412	8845	95.1%	50.9%	21407	2.54	24.3%
B98	8103	8888	91.2%	50.9%	20617	2.54	24.0%



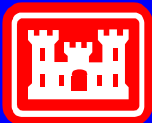
Watervliet Arsenal

Performance Summary

Site 2 – Research Facility (3 units)

January 18, 2002 – January 21, 2003

- Total Run Time 25,416 hrs
- Availability 95.8%
- Capacity Factor 54.1%
- Total Electric Output 68,803 kWh
- Avg. Output for Site 8.12kW
- Electrical Efficiency 25.6%



Watervliet Arsenal

Performance Summary

Site 2 – Research Facility (3 units)

January 18, 2002 – January 21, 2003

Site Performance Matrix

System No.	Total Run Hours	Total Hours	Availability (%)	Capacity Factor (%)	Total Energy Produced (kWe-hrs AC)	Average Output (kW)	Electrical Efficiency (%)
B100	8467	8837	95.8%	53.0%	22446	2.65	25.0%
B102	8283	8856	93.5%	54.7%	22635	2.73	25.1%
B103	8667	8844	98.0%	54.7%	23723	2.74	26.5%



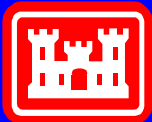
Watervliet Arsenal

Performance Summary

Site 3 – Manufacturing Facility (3 units)

January 18, 2002 – January 21, 2003

- Total Run Time 25,096 hrs
- Availability 94.8%
- Capacity Factor 51.8%
- Total Electric Output 65,008 kWh
- Avg. Output for Site 7.8kW
- Electrical Efficiency 24.56%



Watervliet Arsenal

Performance Summary

Site 3 – Manufacturing Facility (3 units)
January 18, 2002 – January 21, 2003

Site Performance Matrix

System No.	Total Run Hours	Total Hours	Availability (%)	Capacity Factor (%)	Total Energy Produced (kWe-hrs AC)	Average Output (kW)	Electrical Efficiency (%)
B104	8382	8844	94.8%	51.5%	21566	2.57	24.2%
B105	8194	8769	93.4%	52.4%	21449	2.62	25.2%
B106	8520	8856	96.2%	51.6%	21993	2.58	24.3%



Watervliet Arsenal Program Highlights

January 18, 2002 – January 21, 2003

- 10 Plug Power Units - 5kW PEMFC
 - 93.7% Total Availability
 - > 83,000 Run Hours
 - > 214,500kW-hrs
- System B103
 - 100% Availability Final 4.5 Months
 - 98.8% Availability Final 11.5 Months
- System B98
 - 6742 Cell Stack Run Hours
- System B104
 - 7056 Cell Stack Run Hours



